New and Improved GLDAS data sets and data services at NASA GES DISC

Hualan Rui[1,3], Hiroko Beaudoing[2,4], William Teng[1,5], Bruce Vollmer[1], Matthew Rodell[2], Guang-Dih Lei[1,3]

[1]Goddard Earth Sciences Data and Information Services Center (DISC), Code 610.2, NASA, Greenbelt, MD, United States
[2]Hydrological Sciences Laboratory(HSL), Code 614.3, NASA, Greenbelt, MD, United States
[3]ADNET Systems, Inc., 164 Rollins Avenue, Rockville, MD 20852, United States
[4]Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD 20742, United States
[5]Wyle Information Systems, Inc., 1651 Old Meadow Road, McLean, VA 22102, United States

Hydrology Data and Information Services Center (HDISC)
NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC)
Help Desk: gsfc-help-disc@lists.nasa.gov
http://disc.gsfc.nasa.gov/hydrology
Email: Hualan.Rui@nasa.gov

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Introduction

- The goal of a Land Data Assimilation System (LDAS) is to ingest satellite- and ground-based observational data products, using advanced land surface modeling and data assimilation techniques, in order to generate optimal fields of land surface states and fluxes data and, thereby, facilitate hydrology and climate modeling, research, and forecast.
- With the motivation of creating more climatologically consistent data sets, NASA GSFC's Hydrological Sciences Laboratory has generated more than 60 years (Jan. 1948 – Dec. 2008) of Global LDAS Version 2 (GLDAS-2) data, by using the Princeton Forcing Data Set (Sheffield et al., 2006) and upgraded versions of Land Surface Models (LSMs).
- GLDAS data and data services are provided at NASA GES DISC Hydrology Data and Information Services Center (HDISC), in collaboration with HSL and LDAS.

GLDAS Version 2 (GLDAS-2) Data

- GLDAS-2 Noah Experiment-1 monthly and 3-hourly 1º x 1º data sets (1948-2008) have been released to the public by the NASA GES DISC.
- While GLDAS-2 data are becoming available incrementally, more than 30 years (Jan. 1979-present) of GLDAS Version 1 (GLDAS-1) data, simulated by CLM, Mosaic, NOAH, and VIC models, remain publicly accessible and are still growing.

GLDAS Basic Characteristics	
Content	Water and energy budget data forcing data
Spatial coverage	All land north of 60° South
Spatial resolution	0.25° and 1.0º
Temporal coverage	Version-1 1.0°: Jan. 01, 1979 - present 0.25°: Feb. 24, 2000 - present Version-2 1.0º : Jan. 01, 1948 - 2008
Temporal resolution	3-hourly and monthly
Forcing	Multiple data sets derived from satellite measurements and atmospheric analyses
Land surface models	CLM, Mosaic/Catchment, NOAH VIC
Output format	GRIdded Binary (GRIB)
Elevation definition	GTOPO 30
Vegetation definition	University of Maryland, 1 km

Four ways to access the data

- **Mirador data search and download**
  - Parameter and spatial subsetting
  - NetCDF conversion
- **GrADS Data Server (GDS)**
  - Visualization and analysis
  - Parameter and spatial subsetting
  - Output Types: Binary, ASCII, Image
- **FTP downloading**
  - Quick access and batch processing
  - Navigation based on date
- **Giovanni Portals**
  - Online visualization and analysis
  - Parameter and spatial subsetting
  - Output Types: HDF, NetCDF, ASCII, and Image (GIF/PNG/KMZ)

Hydrology Data Holdings Portal: http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings
The portal lists all GLDAS and NLDAS data sets along with links for accessing the data via Mirador, GDS, ftp, Giovanni, and README document.

Updates to Each GLDAS-2 Land Surface Models

Model - resolution	GLDAS-1	GLDAS-2	Remarks
NOAH 1º x1º	Version 2.7	Version 3.3	Updated model parameters that specify the initial soil temperature
CLM 1º x1º	Version 2.0	Version 3.5	Used MODIS based parameter data sets, stand alone
VIC 1º x1º	Water balance mode	Energy balance mode	Includes all variables
Mosaic 1º x1º	Mosaic (GSFC)		Model switch
Catchment 1º x1º		Catchment	
NOAH 0.25º x0.25º	Version 2.7, Snow DA: direct insertion	Version 3.3, Snow DA: forward-looking	Updated bottom temperature

Hydrology Data Holdings Portal
Land Data Assimilation System

What's New about GLDAS-2 Data

Recent updates of Princeton Forcing Data

Princeton Forcing data set (Sheffield et al., 2006) provides near-surface meteorological data for driving land surface models and other terrestrial modeling systems. Since its creation in 2006, the data set has been updated and improved several times. The latest update includes correction in Downward Shortwave Radiation, Humidity, and Temperature fields, http://hydrology.princeton.edu/data/pgf/1.0deg/3hourly/Readme_3hourly.txt.

GLDAS-2 data will be generated by using:

- Updated models (Noah, Catchment, CLM, and VIC)
- Updated land cover, land mask, and other vegetation maps based on MODIS data
- Experiment 1 (1948 – present): Updated Princeton Forcing Data
- Experiment 2 (2001 – present): Observation based forcing data

GLDAS-2 NOAH Model Data:

Current GLDAS-2 Noah Model (V2.71) Experiment 1 Data (1ºx1º monthly and 3-hourly) will be updated by regenerating the data with updated Noah model (Noah3.3), the updated Princeton Forcing Data, and the updated land surface parameters. 0.25ºx0.25º monthly and 3-hourly data are coming soon in summer 2012.

GLDAS-2 Catchment Model Data:

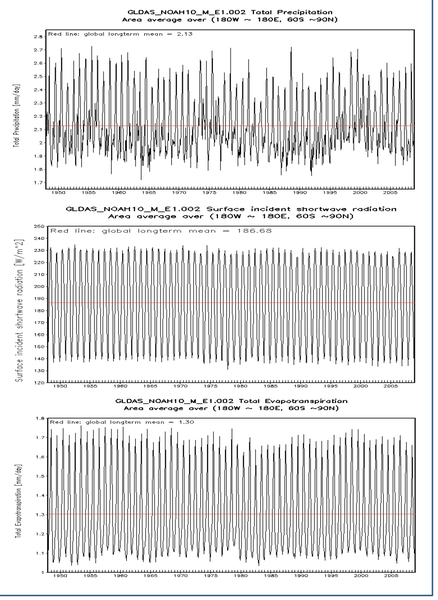
- Catchment model was developed by Randy Koster et al at GSFC (the same group who developed Mosaic).
- 1ºx1º monthly and 3-hourly Experiment 1 Data are coming soon in summer 2012.
- Similar to Noah model data, Catchment model data contain 29 variable fields.
- However, unlike most LSMs, the soil water prognostic variables are not strictly associated with soil layers, http://nsipp.gsfc.nasa.gov/research/land/catchment.html.

GLDAS-2 CLM and VIC Model data will also be forthcoming……

Please visit GES DISC Hydrology Portal for updates, http://disc.sci.gsfc.nasa.gov/hydrology.

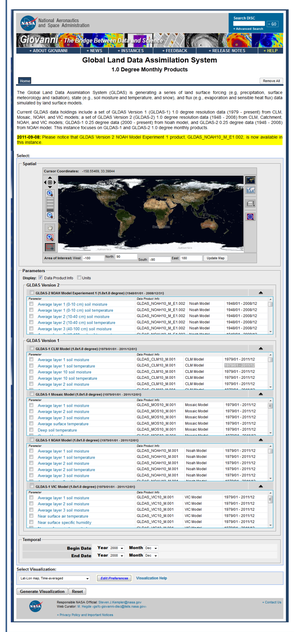
Improvements in GLDAS-2 Data

- In GLDAS-1, source of forcing data was changed several times during the 30-year data record. As a result, model output data show some discontinuities corresponding to dates of forcing data changes.
- GLDAS-2, using the improved forcing data from Princeton, has generated 61 years of improved and climatologically consistent data, using updated LSMs.
- The global mean time series of Total Precipitation (rainfall + snowfall, right-upper) and Surface Incident Shortwave Radiation (right-middle) show 61-year temporally consistent data.
- Global mean time series of Total ET (right-lower) shows the improvement of the 61-year consistent intensity and annual cycles.
- Other variables (not shown here) of GLDAS-2 model outputs also show improved data consistency.



Giovanni Portal for GLDAS Data

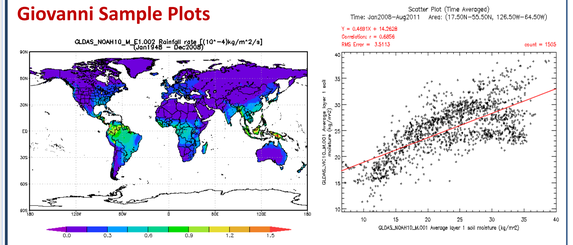
http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_M



Giovanni is a Web-based application developed by NASA GES DISC that provides a simple and intuitive way to visualize, analyze, and access vast amounts of Earth science remote sensing data without having to download the data.

Giovanni GLDAS Monthly Portal provides online visualization, analysis, and intercomparision for monthly 1 x1 GLDAS-1 and GLDAS-2 data from CLM, Mosaic, Noah, and VIC models.

Giovanni Sample Plots



- 60-Year Rainfall Climatology (upper-left) from GLDAS-2 Noah Experiment 1 monthly 1ºx1º data.
- Scatter Plot of Soil Moisture (upper-right) from GLDAS-1 Noah and VIC monthly 1ºx1º data.
- The two plots were directly generated by Giovanni GLDAS Monthly Portal, without downloading any data.
- Giovanni GLDAS 3-hourly Portal: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=GLDAS10_3H

NLDAS Data at NASA GES DISC

- More than 30 years of North American Land Data Assimilation System Phase 1 (Aug. 1996 – Dec. 2007) and Phase 2 (Jan. 1979 – present, with a latency about 4 days) are also accessible via Hydrology Data Holdings Portal, http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings.
- Available NLDAS data are 0.125º x 0.125º hourly data. Monthly data will be coming soon.
- NLDAS Phase 2 (NLDAS-2) Noah model data have been released to public recently.
- NLDAS data from SAC and VIC will also become available soon.
- All NLDAS data are accessible via Giovanni NLDAS Hourly Portal, http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=NLDAS0125_H.

Summary

- To date, GLDAS and NLDAS have generated more than 60 years (1948 – present) and 30 years (1979 – present) of data, respectively. These quality-controlled, spatially and temporally consistent terrestrial hydrological data could play an important role in characterizing the spatial and temporal variability of water and energy cycles and supporting climate research.
- All data are accessible at NASA GES DISC Hydrology Data Holdings via Mirador, ftp, GDS, or Giovanni (http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings).
- Giovanni GLDAS and NLDAS portals further facilitate access and use of the data. The portals provide a simple and intuitive way to visualize, analyze, and access the data without having to download the data.
- GLDAS-2 Experiment 1 data (1948-2008) will be generated by using updated Princeton Forcing Data, updated LSMs, and updated land surface data. Current existing GLDAS-2 Experiment 1 Noah data will be regenerated.
- GLDAS-2 Experiment 2 data (2001 – present) will be generated by using observation based forcing data, with a latency of around a month.

***GLDAS** is supported by the NASA Energy and Water cycle Study (NEWS).*
*More information about GLDAS and NLDAS can be found at **http://ldas.gsfc.nasa.gov/**.*
***NLDAS** is a collaboration project among several groups (NOAA/NCEP/EMC, NASA/GSFC, Princeton University, University of Washington, NOAA/OHD, and NOAA/NCEP/CPC) and is a core project of NOAA/MAPP.*

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